

Waste Panel Expected To Back Interim Storage

A blue-ribbon commission signals that spent nuclear fuel should cool above ground while the United States figures out long-term disposal

sciencemag.org Podcast interview with author Eli Kintisch.

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AFTER KILLING THE PROJECT TO ESTABLISH A nuclear waste repository at Yucca Mountain, Nevada, last year, President Barack Obama set up a commission to chart a new course for U.S. nuclear waste policy. The group, which is set to deliver its interim findings at the end of this month, is expected to say that the answers to America's nuclear waste conundrum are technically feasible. The problem, however, is that those solutions are likely to be, in political terms, radioactive.

The Blue Ribbon Commission on America's Nuclear Future confronts a challenge that has stymied Washington for 40 years: the nation's relentless production of nuclear waste. In recent decades, U.S. reactors have created more than 2000 metric tons of highly radioactive spent fuel each year. Codified in law in 1987, the Yucca plan meant the spent fuel, held in bundles of 4-meter-long zirconium alloy tubes, would be cooled for up to a decade in storage pools at U.S. reactors. Then it would be shipped to Yucca Mountain, transferred into steel cylinders, and further cooled by fans for 50 years. When the facility contained 70,000 tons of waste, it would be closed up.

In the past 24 years, the Department of Energy (DOE) has built an 8-kilometer-long tunnel at Yucca and has conducted experiments to ensure that the repository could hold the waste for up to 1 million years without releasing dangerous amounts of radiation. But although the government has spent roughly \$10 billion on the project, lawsuits, red tape, and political opposition have prevented DOE from disposing of a single ton of commercial fuel. About 65,000 tons of spent nuclear fuel are piled up at U.S. reactors in cooling pools and in steel-and-concrete casks stored outdoors. Some experts believe the pools represent unacceptable safety or environmental risks in the case of natural calamity or terrorist attack. But moving cooled-down fuel from U.S. pools into casks, which are considered safer, would cost utilities billions of dollars.

To alleviate this pressure on reactor sites and buy the government time to establish a permanent repository, the commission will likely call for an important new step: interim storage of the fuel in one or several central locations. After cooling in pools for a decade, fuel would be transferred to such a facility to be stored in outdoor steel-and-concrete casks for "multiple decades up to 100 years or possibly more." Over that period, the commission envisions,

expanded federal research into fuel recycling or other technologies might reduce the amount of fuel requiring disposal. Meanwhile, federal officials would have a second chance to establish a permanent U.S. geologic repository— this time, perhaps, in a fashion less acrimonious than the Yucca effort.

Buying time

“Consolidated interim storage preserves options while other aspects of an integrated waste management strategy can be developed,” says one of three commission subcommittee reports released in June. Later this month, an interim report from the full commission is expected; given the hundreds of hours of public testimony and published documents cited in the lengthy subcommittee reports, experts expect the final version, scheduled to be released in January 2012, to offer substantially the same conclusions. In addition to paving the political and logistical route to disposal, central, interim storage sites could make the repository easier to design and build. Building the Yucca repository required a number of engineering tradeoffs, explains physicist Charles Forsberg of the Massachusetts Institute of Technology (MIT) in Cambridge, and the site’s “awkward” design was a stumbling block to getting it licensed.

One reason was that Yucca Mountain had to cool waste before permanently storing it. Spent fuel straight from the reactor can quickly reach 1500°C, hot enough to destroy the tubes that hold it. Cooling for about a decade in storage pools dissipates most of the heat from the shortest-lived isotopes. But after being bundled together and entombed in the mountain for centuries, it might still gradually create enough heat to aid corrosion of the tubes, create dangerous steam within the tunnels, or even, over time, alter the geology of the site. First cooling the waste for at least 5 decades at interim storage sites could eliminate the need for fans at a permanent repository, says Forsberg, co-author of several influential MIT reports on nuclear waste. The interior of the long-term repository—compared with Yucca Mountain—would also require less ventilation and less access by remote devices to handle the fuel after emplacement, and it could be more easily sealed with an appropriate fill.

In any case, experts agree, some new plan for waste storage is essential. Waste currently stored in pools and casks at U.S. sites does not pose “unmanageable ... safety or security risks,” says a subcommittee report. But every ton that stays at reactor sites makes those risks slightly greater. Fuel in U.S. spent fuel pools is packed four times as densely as it was 25 years ago, raising concerns about the risk of explosions or meltdown if the pools were to empty in an accident. The tsunami that devastated the Fukushima nuclear plant in Japan in March may have resulted in a loss of water in one of its ponds (*Science*, 1 April, p. 24). A draft commission report says the issue of the safety of keeping fuel densely packed in pools should be “reexamined,” although “it is still too early to draw definitive conclusions” from the Fukushima accident. It calls for an expert panel at the National Academies to tackle the subject.

If an interim storage site could get licensed—a big if, given political sensibilities—it might save money for utilities and the government, which is currently paying hundreds of millions of dollars in legal claims to utilities for the waste. Nine decommissioned reactor sites in the United States currently house nuclear fuel in aboveground casks. Centralized storage could save utilities billions in security costs and by freeing the land for other uses.

As for long-term disposal, commissioners say the government should “expeditiously” move to set up a geologic repository—they were told not to specify where. “There is no ethical basis for abrogation of responsibility” for securing nuclear waste “to future generations,” a subcommittee report says. To avoid repeating the Yucca Mountain experience, which was plagued by opposition from the state of Nevada (see p. 150), the process of choosing a site should include “consultation, transparency, accountability, and scientific and technical credibility,” a draft report says. Commissioners are also likely to call for **the project to be managed by a new, independent entity.**

The commission is also likely to recommend expanding research into technologies such as reprocessing, in which nuclear waste is converted back into nuclear fuel, and into advanced or more efficient reactors that might produce less waste. Nuclear power will never be completely clean, however. “No currently available or reasonably foreseeable reactor and fuel-cycle technologies ... have the potential to fundamentally alter the waste management challenge,” the research subcommittee draft says.

The road ahead

Forecasting what the Blue Ribbon Commission will recommend is one thing; predicting what the Obama Administration and its successors will actually do with them is much harder. Several environmental and antinuclear groups have already spoken out against creating new storage sites for waste, and a commission subcommittee admits in a report that it’s a “contentious issue.” Commissioners hope the track record of the 57 licensed fuel storage facilities—most at U.S. reactor sites—will alleviate some fears, and that an open site-selection process coupled with “incentives” like training and jobs for local communities and utilities will ultimately carry the day. But even simply getting money for more federal research into nuclear power could be a challenge. As the budget process in Washington grows ever more contentious, lobbyists and activists alike are increasingly skeptical that substantial increases can happen soon. “I don’t think the budgets are going to expand beyond what they are now,” says physicist Thomas Cochran of the Natural Resources Defense Council in Washington, D.C.

—ELI KINTISCH

Online

Hot stuff. Spent fuel being lowered

into a storage cask at a commercial nuclear reactor in Virginia.

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